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Chronic Infections from the Perspective of Evolution: a Hypothesis

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Abstract — No satisfactory explanation has so far been given for the persistence in the body sometimes, of various microorganisms – bacteria, parasites, fungi and viruses – in spite of their foreign antigens and a competent immune system. It has been proposed as an explanation that these microorganisms, in the course of evolution, have concealed their true antigens from the immune system. Free living microorganisms concealed their true antigens when the heat of the sun, with the threat of dehydration, induced the development in surviving mutants of a lipid coat to reduce surface water losses. This coat enveloped the microorganisms, concealing their true antigens. Viruses that cause chronic infections concealed their true antigens beneath a viral envelope derived from host cell. Exposing the true antigens on microorganisms and viruses with suitable lipid solvents and re-introducing the microorganisms and viruses so treated into the host as a kind of vaccine, should provoke a new immune response effective in eliminating the pathogens concerned from the body and in preventing future infections. In this way, pathogens could be used to treat and prevent certain infectious diseases. The above procedure should have significant benefits for human and animal health.

Introduction

Why are certain infections chronic? Why is tuberculosis, leprosy, malaria or onchocerciasis chronic? Chronic infections are caused by a variety of microorganisms – bacteria, fungi, viruses and parasites of various kinds. Whilst these various microorganisms may differ in their physical and biological characteristics, *their common chronicity in the human body may be the manifestation of some biological feature or quality common to all of them.*

If one could identify and understand this common feature, the information thus derived could provide the basis for the manipulation of the microorganisms concerned to provide an effective immunogenic stimulus when these organisms are re-introduced into the body as immunotherapy.

Before considering any possible features common to these various microorganisms, it should be recalled that they are all foreign to the body and from the immunosurveillance point of view are regarded by the host as 'non-self'. Such foreign antigens in theory should provoke an immune response that should eliminate them. yet these microorganisms persist and multiply in the body as if there were immuno-paresis or immunodeficiency of the host. The tubercle bacillus, leprosy bacillus, hepatitis B virus, onchocerca volvulus, malaria parasite and more recently the HIV

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or AIDS virus (1, 2) are some examples of microorganisms that persist and thrive in the body for years despite the presence of an immune response.

The persistence of these microorganisms in the body, despite their foreign antigens poses a problem that has not been satisfactorily explained.

One explanation that has been proposed for the persistence of these microorganisms is that there is an inherent immuno-depression in the person affected. Since congenital and iatrogenic induced immune depression are frequently associated with chronic infections of various kinds, it is tempting to conclude that those with chronic infections are also inherently immuno-depressed. This is unlikely to be the case for two reasons. First, it is unlikely that the hundreds of millions of persons world-wide with the chronic infections mentioned above are all inherently immuno-depressed or deficient. It is also unlikely that the AIDS epidemic now occurring is due to a recent epidemic of immune deficiency. Secondly, the immune depression seen in some of these patients, for example AIDS, occurs after, and not before, the infection. Perfectly immuno-competent persons have become immuno-incompetent in the course of AIDS infection. Similar immuno-depression has been reported following most parasitic infections, for example malaria (3). The evidence for inherent immuno-depression or deficiency as an explanation for these chronic infections is therefore not convincing.

Another explanation that has been proposed is that the antigens of the microorganisms change constantly so that when antibodies are produced to a given antigen, that antigen is no longer there, so to speak, when the antibodies arrive. Antigenic variation has indeed been reported in several parasitic infections notably in trypanosomiasis, and malaria (4, 5). The AIDS virus is believed to owe its chronicity to this mechanism also and this has frustrated attempts to produce an effective vaccine against it. Genetic mutation and selection could account for the way in which new variants of the microorganism concerned develop.

It should be pointed out however, that the serological diagnosis of many chronic microbial infections including AIDS is possible only because the microorganisms concerned share a minimum of the same antigens and these apparently remain constant over a period of time. Failure of antibodies to such common antigens to eliminate the microorganisms concerned must be due to reasons other than antigenic variation.

Why antibodies do not eliminate the microorganisms against which they are produced continues to be the fundamental question in the immunology of chronic microbial infections. Is it possible that the antibodies produced at present are intended by microbes merely to divert the immune system of the body away from themselves?

It is perhaps time to look beneath the variable surface antigens of microbes!

A new hypothesis

True antigens are concealed

A new explanation being offered for chronicity, and this deserves further examination, is that the microorganisms as part of their evolution and survival in the body, may have managed to conceal those true antigens which alone would have provoked an immune response that would have successfully eliminated them from the body. It is the search for such hypothetical concealed true antigens in microorganisms that could advance our knowledge of the immunology of chronic microbial infections.

Since microorganisms make contact with the host immune system through their surface, an understanding of the surface structure of the wall of microorganisms, that of the tubercle bacillus for example, could show whether or not 'new' and effective antigens which could be really useful to the host immune system, were partially or totally concealed in it.

Information concerning the structure of the wall of the tubercle bacillus exists in specialized works of microbiology but it says nothing about the possible concealment of antigens in it.

A mechanism for concealing the true antigens

Evolution probably played a part in the concealment of the true antigens. Without engaging on the speculations of evolution and on the controversy of how and where microorganisms first came into being, it can be assumed that when the tubercle bacillus for example first came into being, perhaps in the primordial sea, it must have had specific surface antigens which distinguished it from other microorganisms. Such original surface antigens may be considered as the true antigens of the tubercle bacillus and under aquatic conditions may have played a part in communication between organisms.

This primitive bacillus, as a free living microorganism exposed to the heat of the sun and the dry conditions on land was almost certainly threatened with extinction by dehydration. Only mutants which could resist this dehydration from the sun could have to survive on land and those that could not resist, killed off and eliminated.

How was such resistance achieved? It is difficult be certain at this point in time but it is easy to imag

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Later on in the course of time mutants appeared which entered mammalian tissues and became its subsequent transmission or p to patient or one animal to anoth must occasionally survive for da in the dust, or dried sputum befor a new host. It could survive such h hazards only because its ancesto quired a lipid covering that was g and could resist the dry condition

Does the tubercle bacillus hav if so what are its biological chara genicity. Whether a lipid coat exis most crucial issue. What is impor which had to survive under the indicated above, must somehow s perish. Since lipid substances are occurring substances for reducing ture it has been concluded that th be a lipid covering on the bacillus The presence, effectively, of lip tubercle bacillus is indeed a well fact. In the Zeihl-Neelson or acid slide with the tubercle bacillus is with fuchsine because many worke bercle bacillus to have a waxy cell softened by heat so that the stain ca As regards their antigenicity, clinica rms that antigens of the tubercle an ineffective response because it acillus. This is so probably becau directed against external lipid cover

however, that only those mutants that could acquire a protective covering to reduce or stop water losses from its surface would survive on dry land.

In the biological world, oils, lipids and waxes are naturally occurring substances that reduce surface water losses in plants and animals. Where such losses are great the lipid material assumes a wax like nature as for example in desert plants such as cacti.

It is therefore quite probable that only those mutants of the tubercle bacillus that could provide a lipid or wax-like covering to protect themselves from the sun and heat would survive on land. The lipid protection had to be efficient given the microscopic water content in the bacillus.

The protective lipid covering that enabled the bacillus to survive on land must have covered the whole bacillus including its true surface antigens. From then on, the tubercle bacillus must continue to live on dry land in a kind of protective cocoon, a cocoon that nevertheless had to provide channels for nutrients to enter the bacillus.

Later on in the course of time and evolution, new mutants appeared which entered the human and other mammalian tissues and became adapted to them. In its subsequent transmission or passage from patient to patient or one animal to another, this new bacillus must occasionally survive for days and even months in the dust, or dried sputum before eventually finding a new host. It could survive such harsh environmental hazards only because its ancestors had already acquired a lipid covering that was good for all seasons and could resist the dry conditions on land.

Does the tubercle bacillus have a lipid coat and if so what are its biological characteristics and antigenicity. Whether a lipid coat exists as such is not the most crucial issue. What is important is that mutants which had to survive under the heat of the sun as indicated above, must somehow stop water losses or perish. Since lipid substances are the best naturally occurring substances for reducing water losses in nature, it has been concluded that there is, or ought to be, a lipid covering on the bacillus also.

The presence, effectively, of lipid material on the tubercle bacillus is indeed a well known laboratory fact. In the Zeihl-Neelson or acid fast staining, the slide with the tubercle bacillus is usually steamed with fuchsine because many workers believe the tubercle bacillus to have a waxy cell wall. This must be softened by heat so that the stain can soak in rapidly. As regards their antigenicity, clinical experience confirms that antigens of the tubercle bacillus provoke an ineffective response because it does not kill the bacillus. This is so probably because the response is directed against external lipid covering only or principally and not against the underlying true antigens, a response to which alone could destroy the bacillus.

Thus in acquiring a lipid coat under pressure from the sun, the tubercle bacillus has not only assured its survival in the sun, but it has also succeeded in assuring its survival in the body also by a disguise which has enabled it to escape from the immune system of the body.

Figure 1 is a schematic representation of the tubercle in the 3 phases of its evolution. A at the begionning of its existence, B under the sun and C in mammalian tissue.

Practical application of the new concept

The tubercle bacillus

This new and over-simplified concept of the tubercle bacillus with a lipid coat is useful first, because it helps to conceptualize and so understand an otherwise difficult and complex molecular situation on the bacterial wall and secondly, and more important still, because it suggests some concrete action that could alter the situation.

First, if as the above account suggests, the true specific antigens of the bacillus were covered by lipids under the selection pressure from the sun, we could for example, strip away the lipid covering with suitable solvents and so expose the true specific antigens of the bacillus. If using methods that do not denature, the bacillus were then killed at this point so that it could not repair or reform its lipid coat, by re-introducing such exposed specific or true antigens into the body these would provoke, perhaps for the first time in evolution, a new and primitive kind of immune response. That response will be directed against the true specific antigens of the bacillus beneath its lipid coat. By entering the bacillus through the same channels through which the bacillus must absorb its nutrients this new immune response would kill the intact bacillus and so end its chronicity in the body. A similar procedure could be used to produce from the bacillus a new kind of vaccine against tuberculosis in healthy persons.

Secondly, since tuberculous patients have the lipid-covered antigens from the tubercle bacillus circulating in their body, treatment of the patient's body fluids – plasma, serum and effusions, etc – with lipid solvents should expose the true antigens. Re-introduction of the true antigens thus exposed into the patient should again provoke a new immune response that should kill the bacillus. This could serve as an effective treatment for tuberculosis in patients as well as a vaccine to immunize them against subsequent re-infection.

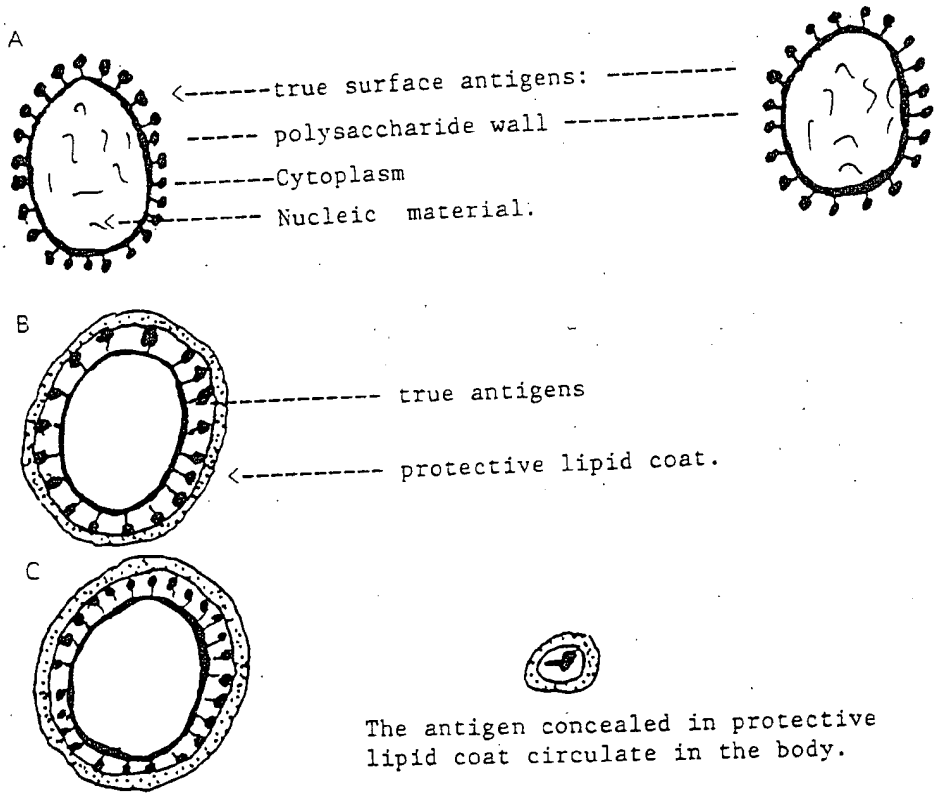

Fig. 1 A schematic representation of the tubercule bacillus in the 3 phases of its evolution: A At the beginning, probably in the sea, the antigens on the surface were useful for communication. B Under the sun on dry land, the true antigens were covered in by a protective lipid coat. C In mammalian tissues, true antigens are concealed by protective lipid from the host immune system.

Using suitable lipid solvents one could therefore produce from the tubercle bacillus and its products, true antigens which could serve as vaccines both for immunising healthy persons and as treatment for patients provided, of course, that their immune systems were competent.

Finding in the tubercle bacillus could be applied to other pathogenic microorganisms

In the preceding discussion, the tubercle bacillus has been used as a prototype of a bacterium that causes chronic infection in the human body. It should be evident however, that all bacteria, fungi and parasites that cause chronic infections in the body also started their evolution millions of years ago, probably in the sea, as the tubercle bacillus did, as free-living independent organisms. In order to survive on land, they must also have acquired a protective lipid coat which covered over, and concealed their respective true antigens. Their chronicity in the body therefore has, should have, a similar or analogous basis to that the tubercle bacillus.

The same arguments must clearly also apply all other pathogenic bacteria such as *vibrio chole* *staphylococcus aureus*, etc, which, whilst not ca ing chronic infections as such, nevertheless cause peated infections in the same individual. Such peated infections have been explained, in the past, the basis of a different strain of the infecting organi causing the different infections.

Phage typing has indeed shown for example, existence of several strains of the *staphylococcus reus*. It is however probable, from the point of vi of evolution, that these various strains had a comm ancestor, millions of years ago, with a single antigen now buried beneath the lipid covering in various strains that exist today. Uncovering that sin true antigen could, when re-introduced into the bo provoke an immune response that should be effec against all the existing strains of the organism.

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Thus, by removing genic bacteria, parasit cause chronic infectio could uncover their when re-introduced i new and more effec microorganisms. The stated above, to protec or to treat infections i microorganisms conc there is a competent i

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Fig. 2 Composite schematic

Thus, by removing the lipid covering from pathogenic bacteria, parasites and fungi, not only those that cause chronic infections but indeed all pathogens, one could uncover their respective true antigens which, when re-introduced into the body, could provoke a new and more effective response to these various microorganisms. These responses could be used, as stated above, to protect the healthy against infections, or to treat infections in those affected by the various microorganisms concerned, provided of course, that there is a competent immune system in the host.

The benefits for human and animal health from this new approach could be very great indeed. Pathogenic microorganisms themselves would be used for treating and preventing infections by them. This would be setting a thief to catch a thief, a new approach indeed.

Viruses

Viruses constitute an obvious exception to the above proposals. Since viruses are believed to have arisen from the nucleic material of pre-existing cells and not as independent free-living organisms from sea, they have never had to survive exposed to the sun as did free living bacteria, fungi and parasites. Consequently they never had the need to acquire a protective lipid coat of the sort that bacteria and other free-living microorganisms had to acquire in the course of evolution.

Nevertheless, viruses such as the herpes simplex virus, the hepatatis B virus, and the retro-viruses, the human immunodeficiency virus or AIDS virus for example, persist in the body for long periods in spite of their corresponding antibodies. They could have done so, as was suggested for the free-living pathogens only by disguising or concealing those true antigens an immune response to which would have eliminated them from the body.

The viral envelope

The above viruses have viral envelopes which they acquired from elements of host cell membrane as they emerged from the infected host cell. These envelopes only confuse the host immune system by presenting it with an antigenic complex that is not entirely foreign but contains components of host tissues, (see Fig. 2) and is perceived by the host immune system as partly self.

An immune response that effectively destroys such an antigenic complex containing host tissue elements, would almost certainly cause a serious auto-immune disease for the body. Using the spectre of auto-immune disease, these viruses have in effect *'blackmailed' the body into a 'compromise'* or ineffective antibodies which, to avoid serious harm to the body, do not also destroy the virus. Even so, there is evidence of some auto-immune damage, which is less than might have been the case in the absence of a compromise.

Consequences of removing the viral envelope

The viral envelope fortunately contains lipo-proteins which are particularly sensitive to lipid solvents such as chloroform and ether. These solvents could remove the envelope and expose what can now be considered as the true antigens of these viruses hidden beneath their viral envelopes. The true antigens thus exposed should provoke a new and more effective response because it is directed against the naked viral particle only. This new response should destroy the virus without any danger to the host cells. This procedure could thus be used to treat and prevent infections by such enveloped viruses.

It is interesting to note that other viruses possessing a viral envelope also persist and cause chronic infections in their respective host, some leading to malig-

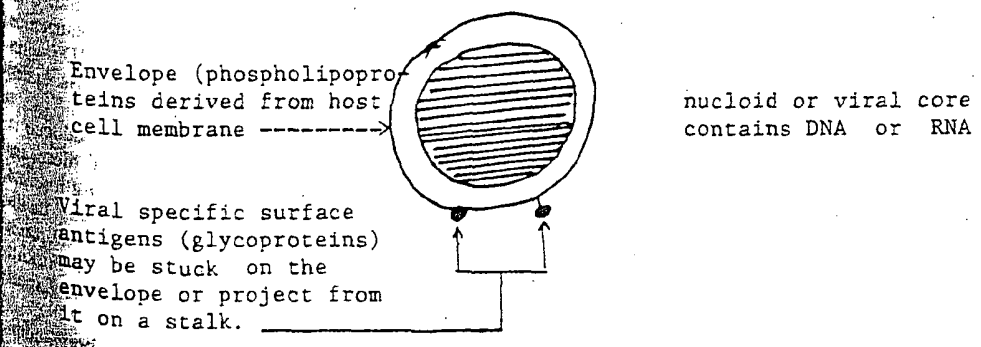
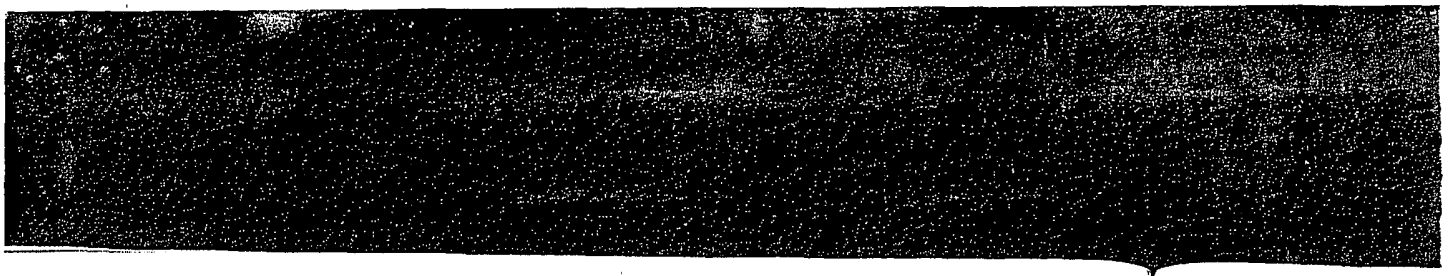


Fig. 2 Composite schematic representation of the essential features of an enveloped virus.



nant tumours as well. The herpes group of viruses and certain retroviruses illustrate this latter characteristic well.

Epidemiological and laboratory studies have associated, for example, the Epstein-Barr virus (EBV), a herpes virus, with Burkitts lymphoma (6), the herpes type 2 virus with carcinoma of the cervix (7, 8) and the cytomegalovirus with Kaposi's sarcoma (9). These are all viruses possessing a viral envelope.

As regards the retroviruses, the HTLV I, the human T-cell leukemia virus, has been associated with T-cell leukemia in various parts of the world notably the Caribbean, Japan, and Africa (10–16).

Retroviruses were first isolated from, and have been shown to cause malignant tumours in many species of animals from chicken and mice to cats and cattle (17–20).

Slow retroviruses or lenteviruses with envelopes also cause chronic diseases in animals such as scrapies in sheep, caprine arthritis encephalitis in goats and equine infectious anaemia (EIA), in horses etc (21–23). Might chronic human conditions such as disseminated sclerosis, and rheumatoid arthritis not be due to some as yet undiscovered slow retroviruses also?

Since the viral envelopes of these various retroviruses as stated above, contain lipo-proteins that can be dissolved by ether or chloroform, these solvents could also remove such envelopes. When reintroduced into the body, the naked viral core antigens would provoke an immune response that should effectively eliminate the viruses concerned because that response is directed against the naked virus core alone, with no risk to normal host cells whatsoever. It should also be stated that the infectivity of an enveloped virus is abolished when it has lost its envelope and the objective of using lipid solvents is to transform the enveloped virus into a non-infective antigen.

The benefits to human and animal health, from this approach to these persistent and chronic viral infections, could be truly great also! Not only would AIDS and other chronic diseases caused by retroviruses be eliminated but other retroviruses and other enveloped viruses that cause malignant tumours in animals and man would also be eliminated and the tumours prevented. By removing the viral envelope, viruses would be used to destroy viruses.

Discussion

The sun that first made life possible on our planet also served free-living microorganisms in their adaptation to life on our common planet. It forced them, if they were to survive on dry land, to acquire a protective lipid coat so as to reduce surface water losses. That lipid coat covered over and concealed those true surface antigens that once enabled microorganisms to distinguish and communicate with each other in the early aquatic phase of their evolution. This concealment also enabled the microorganisms to survive in the body. Antibodies and other immune responses to the micro organism concerned and directed esesntially against the lipid coat have proved ineffective.

Apart from the direct toxic effects of the microorganisms on the body, an important and direct consequence of their persistence in the body in spite of the presence of corresponding but ineffective antibodies is that antigen-antibody complexes are formed which damage the kidneys. The nephrotic syndrome (24, 25) for example is due to such complexes. Ngu and Soothil (26) have estimated that hospital admissions of cases of nephrotic syndrome in some parts of Africa are 100 times higher than in the USA becaus of the greater range of parasite-induced immune complex diseases in the tropics.

Viruses, in contrast to other microorganisms, a believed to have risen from pre-existing nucleic m terial. The persistence in the body of certain virus is believed to be due to the disguise and concealme of their true antigens beneath a viral envelope deriv from, or similar to, the membrane of the host cell which the virus grew. The presence of host element the viral envelope is believed to *'blackmail'* the i mune system of the host into producing compromi antibodies that do not kill the virus in order not to k or severely damage host cells from which the vi envelope was derived. Even so, there is some aut immune damage in these cases, considerably less th might have been the case in the absence of a comp mise. (Incidentally, are other auto-immune diseas caused by enveloped viruses awaiting discovery?)

In their long persistence in the body, these veloped viruses would have had ample opportuni to cause severe damage ranging, for example, fr liver damage by the hepatitis B virus to destruct of the immune system by the HIV and AIDS vi with the disastrous consequences that are associa with these diseases.

In addition, their long and persistent residence the cells would also have given some of these veloped viruses ample opportunities of being inse into the genetic structure of the cell thereby fa tating its malignant transformation. Such is the c for example, of the Epstein-Barr virus and Bur lymphoma, or of the cytomegalovirus and the Ka sarcoma, etc.

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age must also occur in these chronic viral infections. Such damage is usually overshadowed either by the serious damage caused by the viruses on their respective tissues of predilection or by the malignant transformation that occurs in some of them. A search for such renal damage can often be demonstrated (27, 28).

All these chronic persistent infections – bacteria, parasites, fungi and viruses – take a very heavy toll on human and animal health. It would be impossible to accurately evaluate that toll in terms of human and animal suffering and death. An indication in material terms, of the enormity of the problem can be obtained from the huge size of the pharmaceutical industry which is second only to the arms industry.

Our immune system was designed to deal effectively with all foreign agents that invaded the body. Its apparent inability to eliminate certain pathogenic agents from the body has been due, not to an inherent failure of the immune system itself but to the fact that the pathogens have concealed their true antigens from the body.

With the suggestions made above for exposing the concealed true antigens of these pathogens, it should be possible to restore to the immune system their original function of eliminating all invading pathogens. This should result in the considerable reduction of chronic infectious diseases, followed by an equally significant reduction of those malignant tumours that are caused by such agents. Finally, renal and other diseases related to the deposition of antigen antibody complexes in the body should also reduce significantly.

Summary and conclusion

1. Whilst a variety of microorganisms – bacteria, fungi, parasites and viruses – that cause chronic infection may differ in their physical and biological characteristics, their common *chronicity in human body may be the manifestation of a biological or physical feature common to all of them.* That common feature, it now appears, is disguise and the origin of that disguise is to be found in their *evolution.*
2. Most microorganisms except viruses, evolved from primitive free-living unicellular organisms that started life in the primordial sea millions of years ago. In sharing a common aquatic habitat, the various types of unicellular organisms developed surface antigens for the purpose of identification and communication amongst and between the different species.
3. Later, when these organisms eventually moved on to dry land, the threat of destruction by dehydration from the sun obliged mutants that were to survive on land, to develop a protective lipid or wax-like coat against the sun. This protective coat covered over their original surface antigens.
4. When such lipid covered microorganisms later entered the human body and other mammalian species, they presented to the host's immune system '*antigens*' that were in reality only their external coats or coverings. An immune response against this coat did not do any serious damage to the organism itself beneath the coat which therefore continued to live in the tissues as a chronic infection. Such a mechanism could also explain the repeated infections by other pathogenic microorganisms that did not normally cause chronic infections, but which followed the same common course of evolution.
5. By removing the lipid coat from pathogenic microorganisms, their true surface antigens would be exposed to provoke a totally new kind of immune response in the body. This new response should eliminate existing infection as a form of treatment and prevent subsequent infections by the same microorganisms. A new kind of vaccine could thus be produced from most pathogenic microorganisms which could be used for their own treatment and prevention.
6. Since viruses were thought however not to have arisen as free-living organisms but from pre-existing nucleic material, the chronicity in the body of certain viruses could have been achieved only by disguising their true antigens also. One possible method of disguise is to associate viral material with host tissue elements, in the form of viral envelope creating thereby an antigenic complex that '*blackmails*' and compromises the immune system of the body, if it is to avoid serious auto-immune disease, into producing ineffective antibodies.
7. Removal of the lipo-protein envelope by lipid solvent therefore should expose new and true antigens which, when re-introduced into the body, should provoke a new and more effective immune response. This procedure could also be applied to all those viruses which, like herpes group and retroviruses, possess a viral envelope and cause chronic persistent infections and or malignant tumours in their respective hosts.
8. By unmasking the true antigens of pathogenic microorganisms, our immune systems would be better able to deal effectively and efficiently with

them and in the process confer a more effective immunity to the whole body.

9. The practical applications of the suggestions made above should have far-reaching consequences not only on human health but on animal health as well.
10. A new era would be born in which chronic infections, and indeed all infections by external pathogens, could be prevented or treated by vaccines prepared from the pathogens themselves. Man would thus be able, for the first time, to break for a while, the strangle-hold of pathogenic microorganisms on our lives and in our world. This could, itself, change the course of evolution in the years to come.

The scientific community must now take up this exciting new challenge.

Dedication

This article is dedicated to the honour and glory of God.

References

1. Gottlieb M S. Morbidity and mortality weekly record 30.250 1, 1981.
2. Barr-Sinoussi F, Charmann J C, Rey F et al. Isolation of a T-lymphotropic retrovirus from a patient at risk for acquired immune deficiency syndrome (AIDS). Science 1983; 220: 868–871.
3. Greenwood B M. Immunosuppression in malaria and typanosomiasis. In: Porter R, Knight J, eds. Parasites in the immunized host: mechanisms of survival. Ciba Foundation Symposium 25 (New series). Amsterdam, London, New York: Associate Scientific Publishers, 1974: 137–146.
4. Vickerman K. Antigenic variation in African Trypanosomes. In: Porter R, Knight J, eds. Parasites in the immunized host: mechanisms of survival. Ciba Foundation Symposium 25 (New series). Amsterdam, London, New York: Assocaite Scientific Publishers, 1974: 52–67.
5. Brown K N. Antigenic variations and immunology to Malaria. In: Porter R, Knight J, eds. Parasites in the immunized host: mechanisms of survival. Ciba Foundation Symposium 25 (New Series). Amsterdam, London, New York: Associate Scientific Publishers, 1974: 35–46.
6. Epstein M A, Achong B G, Barr Y M. Virus particles in cultured lymphoblasts from Burkitts lymphoma. Lancet 1964; i: 702–703.
7. Rawls W E, Tompkins W A F, Melnick K L. The association of herpes virus type 2 and carcinoma of the uterine cervix. Am J Epidem 1969; 89: 547–554.
8. Nahmias A J, Joseph W E, Naib Z M, Lace C F, Guest B A. Antibodies to herpes virus hominis types 1 and II in human cervical carcinoma. Am J Epidem 1970; 91: 547–552.
9. Giraldo G, Beth E, Henle W et al. Antibody patterns to herpesviruses in Kaposi's sarcoma. II Serological association of American Kaposi's sarcoma with cytomegalovirus. Int J Cancer 1978; 22(2): 126–131.
10. Gallo R C, Poiesz B J, Ruscetti F W. Regulation of human T cell proliferation : T-cell growth factor and isolation of a new type C retroviruses from human T cells. Humatol Bluttransfus 1981; 26: 502–514.
11. Gallo R C, Wong-Staal F. Retroviruses as aetiological agents of some animal and human leukemias and lymphomas and as a tool for elucidating the molecular mechanism of leukemogenesis. Blood 1982; 60 (3).
12. Hinuma Y, Komoda H, Chosa T et al. Antibodies to adult T-cell leukemia-virus associated antigen (ATLA) in sera from patients with AT2 and control. Int J Cancer 1982; 29 (6): 631–635.
13. Yoshida M, Miyosi I, Hinuma Y. Isolation and characterization of a retrovirus from cell lines of human T-cell leukemia and its implication in the disease. Proc Natl Acad Sci USA 1982; 79(6): 2031–2035.
14. Blattner W A, Gallo R C. Epidemiology of human retroviruses. Leuk Res 1985; 9 (6): 697–698.
15. Biggar R J, Melbye M, Kestens L et al. Seroepidemiology of HTLV III antibodies in a remote population of Eastern Zaire. BMJ 1985; 16. 2900 (6471): 808–810.
16. Fleming A F, Yamamoto N, Bhusnurmathi P R, Maharajan R, Schneider J, Huusmann G. Antibodies to ATHV (HTLV) in Nigeria blood donors and patients with chronic lymphatic leukemia or lymphoma (letter). Lancet 1983; 8345: 339–33
17. Rous P. Transmission of a malignant new growth by means of cell-free filtrate. JAMA 1911; 56: 198.
18. Jarret W F, Crawford E M, Martin W B, Davie F. Nature 196 202: 567.
19. Moloney J B. Natl Cancer Inst Monogr 1966; 22: 129.
20. Gilden R V, Long C W, Hansen M et al. J Gen Virol 197 29: 305.
21. Charmann H P, Blades S, Gilden R V et al. EIA: Evidenc favoring classification as a retrovirus. J Virol 1976; 19: 107
22. Gibbons R A, Hunter G D. Nature of Scrapie agent. Natur 1967; 215: 1041–1045.
23. Crawford T B, Adams D S, Cheevers W P et al. Chronic arthritis in goats caused by a retrovirus. Science 1980; 20 997–999.
24. Gilles H M, Hendrickse R G. Possible aetiological role of pla modium malaria in nephrotic syndrome in Nigerian childre Lancet 1960; 1: 806–807.
25. Kibukamusoke J W, Hutt M S R, Wilks N E. The nephrot syndrome in Uganda and its association with quartian mala iae. Q J Med 1967; 36: 393–408.
26. Ngu J L, Soothill J F. Immune complex nephropathy in t Tropics. In: Chandra R K, ed. Critical Reviews in Tropic Medicine. Vol 1. Plenium Publishing Corporation, 1982: 27 306.
27. Luciani J C, Lemaire J M et al. Glomerulopathie extrame braneuse apres hepatite et virus B, Disparition parallele d l'antigene virale et de l'atteinte glomerulaire. Nouv pres Med 1980; 9: 2239–2240.
28. Simon P, Benzenou A, Ramee M P, Deugnier Y. Syndrom nephrotique de l'adulte revelateur d'un hepatite chronique virus B. Ouest Med 1981; (11): 715–718.

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Information an

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Abstract — A model based
expanding pool of cells are
on concepts from informatic
in middle and old age. The
make decisions to maintain
could lead to disease or de
rate with age and the form
property of information syst
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and slowly expand in numb
somatic mutation in expandi
with paternal age. This com
the extrauterine environmen
significant role for the intrau

Introduction

Concepts from information th
ful in analysing the age incide
(1–4). Complex biological sys
a constantly changing environn
making decisions based on info
an uncertain world. No matt
sophisticated the biological sy
chance of error intrinsic to this
serious errors could lead to dis
The strength of the informati
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which therefore must also apply
These properties include the fo

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